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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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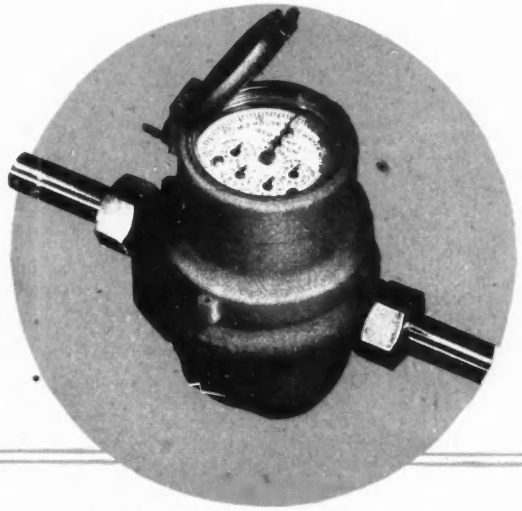

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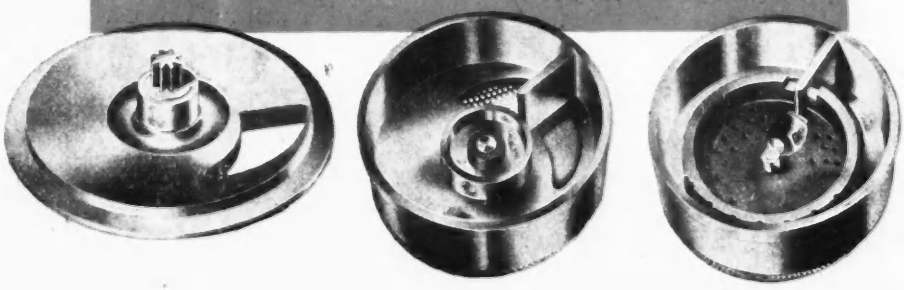

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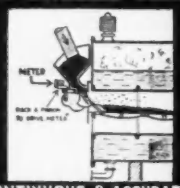

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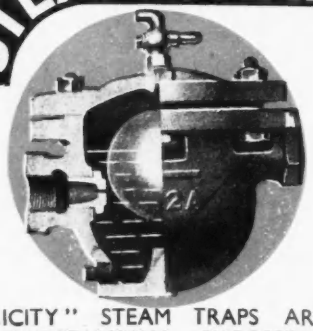

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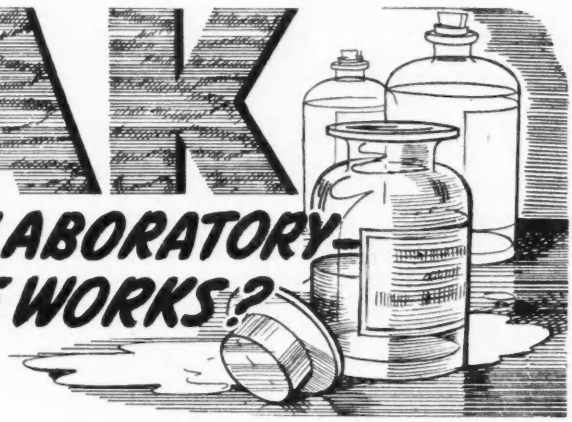

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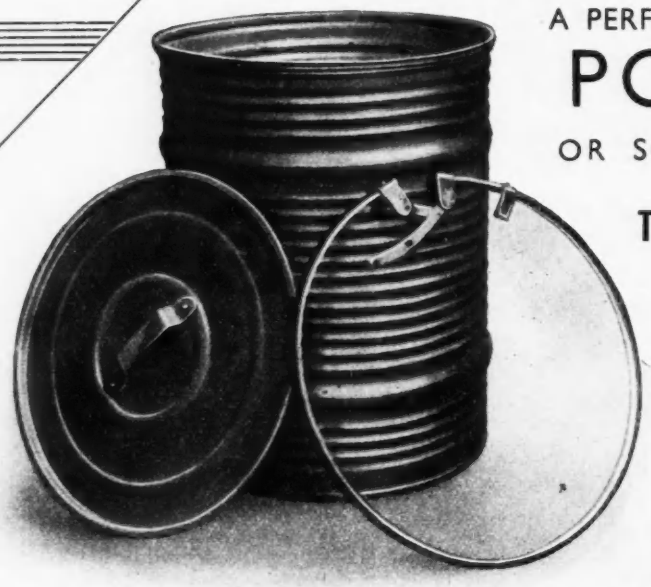

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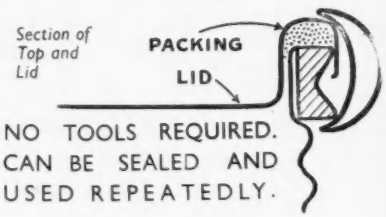

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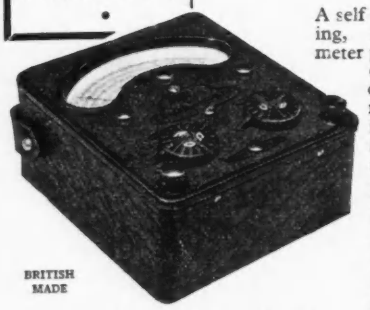

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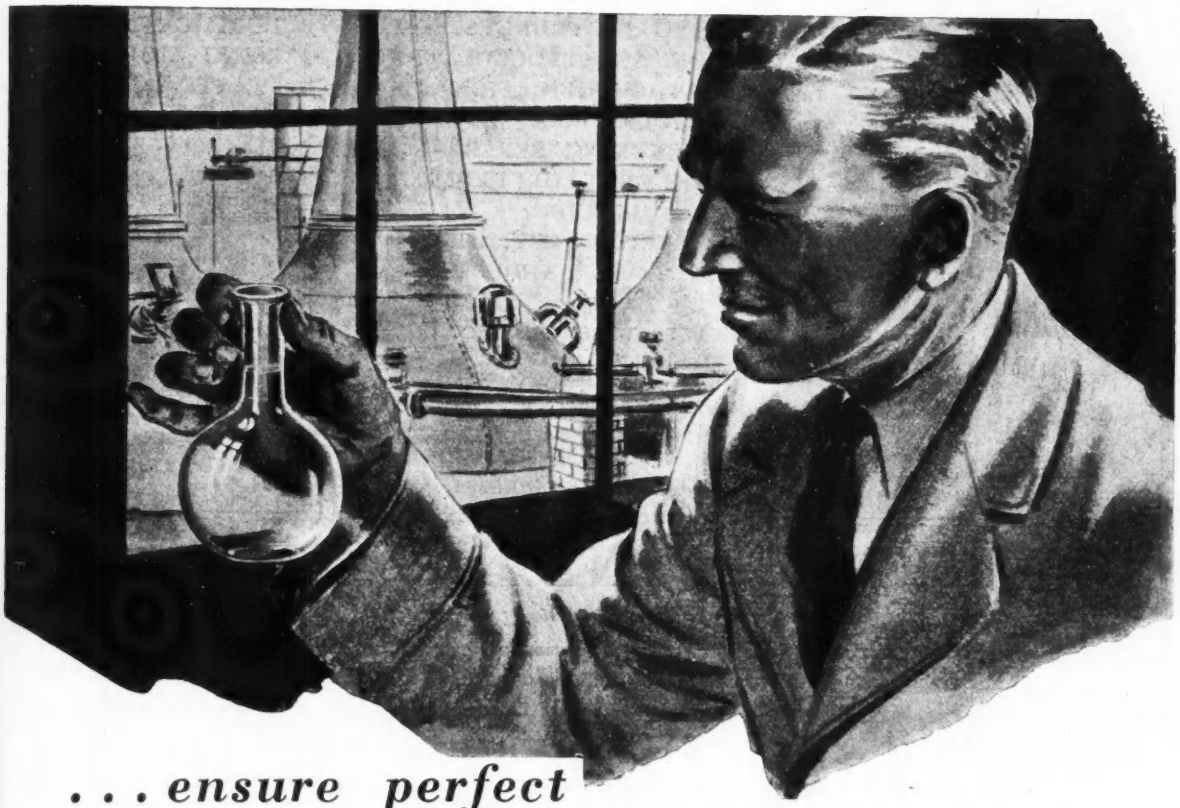

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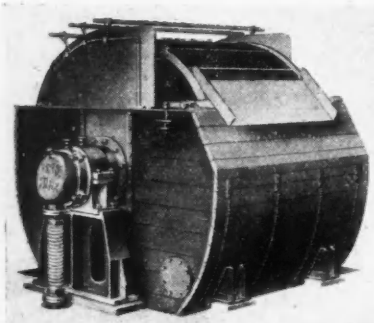

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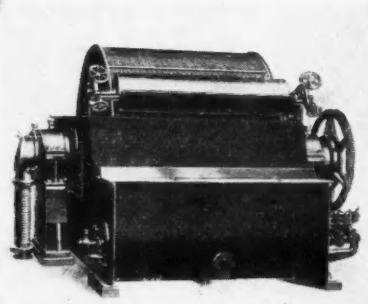

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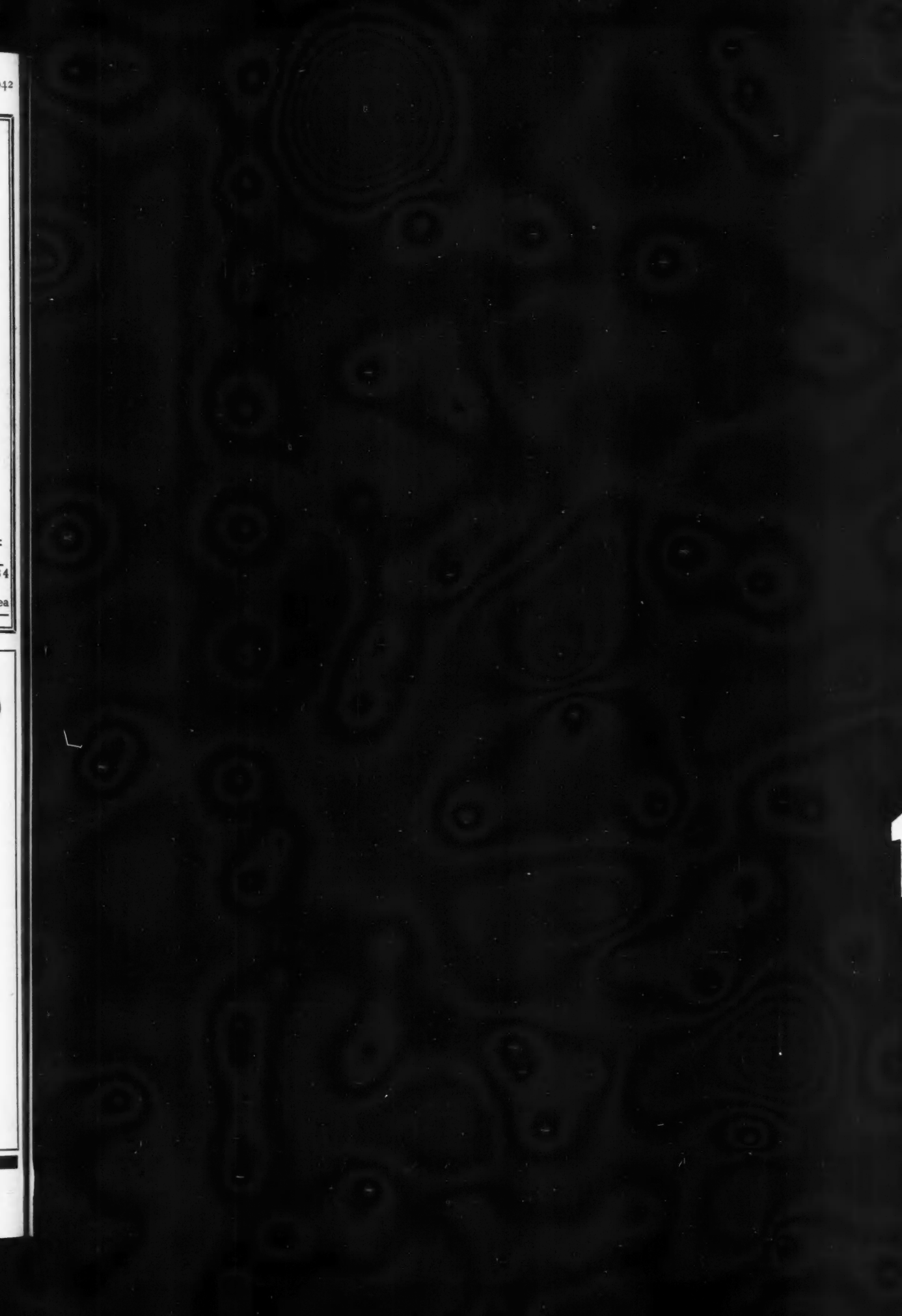

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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VOL. XLVI. No. 1184 March 7, 1942 Annual Subscription, 21s. Overseas, 26s.

Biochemistry in Industry

THE chemical industry can provide many examples of the application of biochemistry. Of these perhaps the predominant is brewing and other forms of fermentation. It is not at the moment our intention to discuss these established biochemical industries, but to call attention to an unsuspected application of biochemistry that has been due to I.C.I. A large water-gas plant was installed by that company, and it was necessary to purify the water gas from hydrogen sulphide. With the overrunning of Holland, supplies of bog ore, required not only at this works, but throughout the gas industry, became limited to stocks held in the country and native raw materials. There was a good deal of difficulty in getting the requisite supplies and the position began to look somewhat serious. When iron oxide is used for removal of hydrogen sulphide from gas it is usually necessary to lighten it by addition of sawdust, peat, or other material, in order that the gas shall be able to flow freely through the solid mass. Nothing special had been discovered as the result of this practice until the apparently chance discovery was made by I.C.I. that peat could remove hydrogen sulphide from gas in certain circumstances. In practice the use of unadulterated peat is not successful, but a mixture of peat with iron oxide in equal volumes has proved peculiarly suitable for the purpose, and has enabled the sulphur content of the spent oxide to be brought up to a satisfactory figure.

The application of peat to this purpose depends on the fact that it contains sulphur bacteria. These bacteria are present only in relatively small numbers in the peat as mined, probably because the conditions of growth are not such as lead to rapid reproduction. Peat is acid in reaction (as is testified by the well-known acidity of peaty waters), and sulphur bacteria appear to thrive best in a more alkaline habitat. Consequently, when the peat is first put into oxide boxes it is not particularly active, and for some few days considerable quantities of hydrogen sulphide would pass through the boxes if it were not for the presence of iron oxide. In order to bring the peat into an active condition it must be fed with ammonia and, according to a recent paper read by Dr. Quarendon before the Coke Oven Managers' Association and the Newcastle Section of the Society of Chemical Industry, the peat is fed with gas containing 12.5 grains of ammonia per 100 cu. ft.—approximately one-seventh of the quantity of hydrogen sulphide present in the crude gas. This is about three times that normally used for town-gas purification, and in addition the same amount of ammonia is also added to the inlet of the third box. Of the total ammonia added about three-quarters is absorbed, and this is presumably used by the bacteria. The bacteria when fed with ammonia in this way multiply sufficiently to deal with all the hydrogen sulphide. A portion of the ammonia is also used to neutralise the acidity of the peat.

True sulphur bacteria oxidise sulphide first to sulphur and finally to sulphate, but in the peat-oxide purification process the oxidation appears to stop short at the oxidation to sulphur. The reason for this has not been explained, though it is probably connected with the relatively short supply of oxygen. All the sulphur-oxidising bacteria are simple in their needs. They use carbon dioxide as their source of carbon and thus do not require any additional organic matter. They obtain their nitrogen from ammonium salts. Most of them are aerobic, requiring at least a small concentration of oxygen for their development, and the majority flourish best in a medium of *p*H between 6.5 and 8.0. They are not sensitive to temperature though they probably do their work best between 20° and 30° C. In the oxide boxes, when used in peat-oxide mixtures, they are supported on a medium of extensive area, they are fed with carbon dioxide, oxygen, and ammonia, and a continuous supply of hydrogen sulphide is available for them. It thus appears that the conditions are very favourable. In practice the amount of oxygen added is twice that required to oxidise the hydrogen sulphide completely to water and sulphur. It is necessary to see that the peat is kept wet as it does not function well if too dry.

It is evident from Quarendon's paper that a great deal of work is yet required on the sulphur bacteria of peat, which do not appear to have been studied by any previous workers. The technical side of the process seems to be fairly well established, and there is only one obvious drawback, which is that generation of hydrogen sulphide sometimes occurs when using peat, when a box is in the third or fourth position. The degree of purification is thus at times not complete, particularly towards the end of a fouling. This suggests that as well as the true sulphur bacteria, other types are present in peat, such as sulphate-reducing bacteria which reduce sulphates, sulphites, and thiosulphates to hydrogen sulphide. These bacteria are already well known to the gas industry, because they are frequently present in the water of gasholder tanks, and it is by no means uncommon for clean gas to be put into these holders and to emerge containing traces of hydrogen sulphide, from the action of sulphate-reducing bacteria on the sulphates present in the water in the gasholder tank. This difficulty was only discovered when the practice arose of removing naphthalene from

coal gas at the works. It appeared that the presence of considerable quantities of naphthalene in the gas-holder sterilised the water and prevented the bacteria from multiplying. It seems possible that there may be substances present in coal gas which are poisonous to the sulphur bacteria contained in peat and this may be the reason why it is not possible to use peat alone unmixed with iron oxide. Quarendon reports that when a box containing peat only was tried the removal efficiency was very erratic, being good on one day and poor a few days later. This is ascribed to changes in the physical condition of the peat, as influenced by changes in water content. The possibility of poisoning by naphthalene or other constituents of coal tar, however, cannot be altogether excluded.

There is no difficulty in using the spent peat-oxide material for the production of sulphuric acid. We throw out the suggestion, however, that commercially pure sulphur is of more value to industry in general than spent-oxide sulphur. There is at least one large plant in Germany which is producing sulphur from spent oxide and we suggest that the next stage in home sulphur production should be the provision of a number of these plants up and down the country which could work up the spent oxide from all the gas and coke-oven plants in their neighbourhood.

NOTES AND COMMENTS

Bauxite for Japan

A GOOD deal has been written about Malayan rubber and tin supplies, part of which has no doubt fallen "unscorched" into Japanese hands. A recent article on the financial page of *The Times*, however, calls attention to another aspect of the lost resources of Malaya which may well cause more trouble than all the tin and rubber put together. This time it is the bauxite mines of Johore which have to be considered in the light of the new war position. Before the war the Japanese aluminium industry, founded in 1934, relied on metal imports chiefly from Canada, Norway, and Switzerland, and on bauxite supplies mainly from the Dutch East Indies, Greece, and British India. Now, unfortunately, the occupation of Singapore has secured to Japan sufficient bauxite to keep her six or more reduction works in full operation and even to extend their capacity. Mines in Johore are capable of producing at least 100,000 tons a year. In 1940 exports from the island of Bintan (a few miles off Singapore), in the Dutch East Indies, reached 274,345 metric tons, and in preparation for setting up an aluminium industry in Sumatra (which was scheduled to start production later this year) the capacity of the mines had been extended well beyond this figure. Bauxite mines—unlike most other mines—cannot be "scorched" sufficiently to keep them out of production for long, and Japan should very soon have access to something like 400,000 tone of bauxite a year, equivalent to 100,000 tons of metal. Although Japan will be unable to produce more than half this total, unless new works are established, the importance of these supplies of bauxite constitutes yet another urgent reason for cutting sea communications between Japan and the Malay Peninsula.

Smoke Prevention and Fuel Economy

WITH reasonable foresight and control modern technology can ensure that practically the whole of the post-war building shall be smokeless. Without such foresight and control an entirely unnecessary volume of new pollution will add to and help to perpetuate the existing problem," states a memorandum on Smoke Prevention in Relation to Initial Post-War Building, which has been submitted to the relevant government departments by the National Smoke Abatement Society. The Society's principal proposal is that this country should adopt the method that has been successful in the U.S.A. and elsewhere—the logical principle of requiring a competent authority to approve all fuel-burning appliances (other than domestic) before they are installed, both for preventing smoke and promoting the best use of fuel. Particular stress is laid on the importance of smokeless central areas in large cities. The complete smokelessness of all new "commercial premises" (that is, all buildings other than industrial and domestic) is stated to be readily attainable and should be obligatory, while in the central areas existing buildings could be made smokeless with little difficulty. The Society proposes the establishment by the Government of a special Board to investigate this problem, and to prepare the necessary plans. This would link up with a national fuel policy and the setting up of a Ministry of Fuel, the demands for which are supported by the Society. The memorandum is supported by a pamphlet bluntly entitled "No Clean City" which shows how the purposes of post-war town-planning will be frustrated unless they include measures for securing a clean and healthy atmosphere. Stressing also the need for waste prevention, the importance of which has been very thoroughly taught us by the present war, the pamphlet says "The smoke problem is a story of sheer waste from beginning to end. It is a waste that injures the nation as a whole as well as those who suffer directly from the smoke itself. In the first place smoke is derived from the volatile portions of coal that *might* have been extracted to produce useful by-products. Secondly, this volatile material *might* have been burned, as it could have been with proper apparatus and control, to produce heat. Thirdly, the smoke, by the dirt that it produces and the damage that it causes, necessitates a heavy expenditure of money and labour that *might* have been utilised for the production of new goods and services." Either or both publications may be obtained from the Society's temporary address, Woodborough, Nottingham, for 2d., post-free.

Agar-Agar

COMMENTING on Dr. Maurice Ashby's paper on "British Empire Drug Production," we noted, in our last issue of 1941, that Australian and New Zealand agar-agar bade fair to oust the Japanese product. Fresh cause to have faith in this prospect is given in the current issue of the *Bulletin of the Imperial Institute* (*39*, 4, p. 355) where details are given of the work now being carried out in the Pacific dominions towards the development of this product. The matter is, naturally, of particular interest to biochemists and the food-processing industries, but the whole story is a splendid example of combined effort on the part of half-a-dozen different classes of workers, from laboratory researchers to the children of Maori fishermen. In New Zealand, Miss L. B. Moore, Botanist of the Plant Research Bureau, D.S.I.R., first selected three species of marine algæ, *Pterocladia lucida, Pt. capillacea,* and a *Gelidium*, which seemed most promising for the task in hand. The first of these has been fully dealt with: its habitat localised, collectors organised, drying arrangements satisfactorily made, and processing accomplished. The resultant product was submitted to a commercial chemist, who reported that it performed as well as controls of Kobe No. 1 Japanese agar in test cans of sheep tongues in a large meat works, in bacteriological cultures at Wellington Public Hospital, and in standard mycological research. The economics appear satisfactory (seaweed collected mainly by Maori children in a sparsely-populated coastal district of the North Island is delivered dry at Wellington at 9d. per lb.) and preliminary difficulties with processing apparatus have been overcome. With the makeshift facilities so far available a 15 per cent. yield has been secured, but it is reckoned that this could be easily doubled with efficient apparatus. Similar results have been attained in Australia with *Gracilaria* weed, and it seems certain that local requirements will in both countries be fulfilled and a substantial surplus left over for export. In Australia the jelly has already been prepared in leaf form; in New Zealand so far only in powder. It only awaits a supply of jelly trays, however, for this product also to be dried in the manner more familiar to meat-packers.

EVAPORATION OF MILK

An Interesting Field for the Chemical Engineer

by H. SEYMOUR

AN industry which has attained increasing importance in recent years is the evaporation of milk. In order to retain the health-giving qualities of raw milk, leaving the albuminoids in their original form, it is important that the process of evaporation and concentration be performed at the lowest possible temperature; and also that the milk should be in contact with heated surfaces for only the shortest possible time. Types of inclined rapid-circulation evaporators have been designed to meet these requirements, as well as others, which their use in the dairy industry demands.

In this type of evaporator, the milk is rapidly circulated and quickly evaporated; for this reason the milk is in contact with the heated surfaces for an extremely short period. Consequently, the natural flavour is better preserved than in the pan-type apparatus, where the milk is exposed to the heating surfaces for long periods. The operation of the evaporator is semi-continuous, thereby eliminating the losses and delays which are common to some batch operations. Inclined rapid circulation milk evaporators are built in two types; the all-copper type is used for the pre-concentration of milk in making skim-milk powder and for producing evaporated and condensed, whole and skim milk, as well as for making semi-solid buttermilk. The other type is of copper and iron construction, and is recommended where only semi-solid buttermilk is to be produced. It is used also in concentrating buttermilk before drying.

In addition to their general advantages, properly designed evaporators have another good feature which recommends their use in condensed-milk plant. In making evaporated whole milk with this type of evaporator, only a very slight curd is obtained during the sterilising process; and this curd readily shakes out. The natural flavour of the milk as well as the enzymes are preserved, owing to the low operating temperature and the short exposure to heat. This type of evaporator is suitable for the production of any concentrated milk products; and its use can be regulated to meet the demands of the market.

The inclined evaporator lends itself equally well to the needs of the creamery in producing evaporated and condensed skim milk and concentrating skim milk before drying. In the flush season, it can be used profitably in a number of ways. The surplus skim milk can be evaporated and preserved for a future market. Surplus butter-milk, which in many instances is an unmarketable by-product, can be converted into semi-solid buttermilk.

The ease and thoroughness with which inclined evaporators may be cleaned contributes to their low operating cost. Inaccessible nooks and corners where materials might lodge are carefully avoided both in design and construction. The rapid circulation of the milk has a scouring effect that keeps the tubes remarkably free from coating. This assures an efficient heat transfer during operation and makes cleaning extremely easy at the end of the run. The interior of the vapour body on smaller type evaporators may be thoroughly cleaned through a manhole.

Continuous Operation

Milk evaporators are so designed that they may be used in continuous operation. This is accomplished by adjusting the discharge of the pump so that it removes a certain quantity of condensed milk from the evaporator. This quantity is regulated to maintain a uniform concentration of the outflowing milk, and raw milk is drawn in at a rate to maintain a constant liquor level in the evaporator. The evaporator can be equipped with a regulating valve that will automatically maintain the liquor level, so that little attention will be required for its operation. In order to produce large batches of uniform quality, the discharge from the liquor pump is returned to the hot well or tank from which the raw product is drawn into the evaporator. By this method the product is circulated between the evaporator and the hot well until the desired density is reached. When the supply of raw milk is sufficiently large, it can be drawn from successive hot wells until the first is completely filled with a concentrated product of the proper density. The advantage of this system is that concentrated milk can be maintained at a temperature at which there is no danger of bacterial growth, and the product kept under constant observation. If necessary, a batch can be easily standardised. In addition, the capacity of the evaporator is kept at its highest point, because the product of highest density is in contact with the heating surface for a comparatively short period of time, and only at the finish of the batch.

For producing condensed and evaporated whole and skim milk, the evaporator is operated as for producing large batches of uniform density. The evaporated product, delivered by the discharge pump, is run back into the hot well from which the raw product is drawn. As soon as the proper density is reached, raw milk from a second hot well is drawn in, while the evaporated milk is allowed to run back into the first hot well until it is filled. By evaporating the product, at the start, to a little higher density than actually required, the whole batch may be easily standardised by increasing the speed of the discharge pump as the operation nears completion. A decreased density may be obtained by the addition of a small amount of raw milk from the hot well. Thus the product can be kept at a temperature where there is no bacterial growth. The operator can easily observe the progress of evaporation by testing the milk in the hot well.

Superheating a batch, when required, can be accomplished in the hot well by blowing in live steam. While this is being done, a high vacuum is maintained in the evaporator. As soon as the proper consistency is reached, the whole batch is drawn rapidly from the hot well through the evaporator where it is quickly cooled under vacuum.

Milk Powder Production

Several reasons encourage the production of milk powder. Drying creates a profitable outlet for milk by preserving the food elements. It transforms a highly perishable commodity into an easily-transported staple food product. It enables the low-priced milk of the flush season to be held for the stronger market during lessened production. Drying, therefore, efficiently utilises the dairy industry's surplus products, increasing its returns and making such enterprises more profitable. Of the several methods of producing milk powder, the vacuum process has grown in favour among the larger producers. An increasing proportion of the skim-milk powder, as well as nearly all the malted milk produced, in this country and abroad, is dried in this way. All advantages affecting the quality of the finished product are obtainable by the vacuum process. These include preservation of the health-giving vitamins, solubility, good keeping qualities, and flavour.

The moderate price at which it is profitable to sell the high-grade milk powders of to-day, with their good keeping qualities, almost perfect solubility, and retention of the health-giving vitamins, has opened up enormous channels for their consumption. In the past few years the use of milk powders has more than doubled and their uses have become steadily more diversified. The ultimate possibilities for the consumption of milk powder seem almost limitless. In the baking industry alone, it is conservatively estimated that if dried milk were used in a ratio as low as only 5 lb. to the barrel of flour, it would require

approximately 200,000,000 lb. of dried milk to satisfy the demand. Dried milk is used also in large quantities for infant food, ice cream, and confections, while increasing quantities were shipped for domestic use into countries where geographic and climatic conditions prevent fresh milk from being supplied.

Dried milk can be measured accurately and used without introducing a large quantity of water. Additional fat in the form of butter or cream may be added to make up any proportion of milk solids and fat. In the vacuum drying apparatus, thanks to the absence of air, less heat is required for evaporating and drying. Delicate materials can be handled at temperatures as low as 32° C. The degree of temperature at which evaporation or drying occurs depends on the height of the vacuum; the higher the vacuum the lower the temperature. The possibility of working with such low temperatures naturally removes the danger of overheating and assures a uniform high quality in the finished product. Vacuum processes are economical, because moisture and liquids evaporate much more readily under vacuum. Great capacity can be obtained from dryers of smaller size.

LETTER TO THE EDITOR

Oil and the Chemical Industry

SIR,—I have read with great interest your leading articles of December 27 and February 14 regarding the importance of petroleum as a raw material for the chemical industry.

As these raw materials consist mainly of the gaseous and semi-liquid unstable by-products of the refining process, it is evident that they can be available in this country only if refining of petroleum is carried out here on a large and modern scale. I have persistently fought for the idea of home refining as a natural consequence of the technical improvements achieved in the last decade, and I am glad to see that you put forward additional and most important arguments in favour of refining in this country, petroleum to be consumed here, rather than import the finished products from abroad, taking into consideration the requirements of the chemical industry.

The argument that home refining is uneconomical because the proportion of the various petroleum products (motor spirit, lamp oil, gas, diesel and fuel oil, lubricants, etc.) obtainable from crude oil is different from the proportion in which these various products are consumed in Great Britain, was rightly criticised in your paper; the following figures prove this beyond any possible doubt:—

The proportion of the various petroleum products consumed in Great Britain in 1938 was approximately as follows:—

Motor spirit, including white spirit and special naphthas	48%
Kerosene (lamp oil)	7%
Gas, diesel, fuel oil and asphalt	40%
Lubricating oil	5%

The U.S.A., which represents nearly two-thirds of the world production of crude oil, in 1938 manufactured the various petroleum products in the following proportion:—

Motor spirit, including white spirit and special naphthas	48%
Kerosene (lamp oil)	6%
Gas, diesel, fuel oil and asphalt	42%
Lubricating oil	4%

When comparing these two sets of figures, it becomes evident that if all the petroleum products consumed in Great Britain were to be refined here, there would be no surplus of any product which could not be easily absorbed by the market. This argument against home refining falls, therefore, to the ground. It should be borne in mind that modern refining operations, together with a suitable selection of crude oil, make it possible to vary the proportion of the various products obtained within very wide limits without any difficulties or extravagant costs.

The importance of the problem of home refining stressed in your paper becomes all the more pressing when we consider the world position regarding rubber, aviation spirit, plastics, and solvents and when we bear in mind that the British Empire (together with the Dutch), though they were in 1938 responsible for only about one-fifth of the world production of crude oil, controlled more than half of the potential world reserves of petroleum.

We have witnessed, in the last fifty years, the stupendous development of the petroleum industry, which has revolutionised our daily lives as a new source of energy. Undoubtedly we can look forward to still further remarkable development in this direction, but I feel that an even more impressive development started a few years ago in utilising crude oil—our cheapest and richest source of organic material—as a basis for a new chemical industry. Though the quantities involved will probably be only a small proportion of the vast consumption of the oil products employed as fuel, I am convinced that it will bring about an equally big revolution in almost every field of our industrial activity.

It is upon this consideration that I am so anxious that this country should play an important rôle in this new development, the importance of which—for the post-war period—you have so admirably pointed out in your paper. Let us not forget that amongst the main industries which England has developed in the last hundred years, the steel, engineering and textile industries were largely based on imported raw material, and that, for instance, Switzerland has played a much more important rôle in the development of the pharmaceutical and dyestuffs industry, though it does not produce any coal and only very little tar, than Belgium, which is a considerable producer of coal and tar.

In order not to lose sight of the right proportion of things, it is well to remember that the average tanker freight for crude oil or petroleum products, from the country of origin to Great Britain, averaged in the ten years preceding the war about 15s. per ton, which is less than the railway freight from the industrial districts of the Midlands to London.—Yours faithfully,

Adelaide House, London, E.C.4. F. KIND, Ph.D.

March 2, 1942.

Hardness of Plastic Materials

New Test Discussed by Glass Technologists

A NEW method of testing the hardness and scratch-resistance of plastics was discussed by Dr. D. Starkie at the 214th general meeting of the Society of Glass Technology, held in Sheffield recently. Dr. Starkie pointed out that the normal methods of testing the hardness of metals, *e.g.*, the Brinell test and the scratch-hardness test, were not readily applicable to measurements on plastics owing to the deformation of the indentation or furrow with time. The method finally adopted for the measurement of the scratch-resistance of plastic materials consisted in allowing a given mass of carborundum (graded between fine limits) to fall freely from a given height under gravity through a glass tube on to the surface of the specimen, which was inclined at an angle of 30° to the horizontal. The degree of abrasion was determined by measuring, with a photo-electric cell and simple optical system, the amount of light scattered by the abraded surface. The scratch resistance was calculated from the empirical relation, scratch resistance being equal to 1000/(deflection of the photocell galvanometer for light scattered by the sample). Relative values for the scratch resistance of Perspex, plate glass, and "Pyrex" glass, obtained by this method were 20, 115 and 180.

Other interesting papers dealt with the effect of temperatures on the breaking strength of glass (Dr. G. O. Jones and Professor W. E. S. Turner); with the determination of the elastic and viscous properties of glass at temperatures below the annealing range (Dr. Jones); and with the strength of glass tubing (Mr. H. E. Mellor). It was emphasised in these papers that, in temperature tests, a large number of specimens should be tested at each temperature considered. The futility of using smaller numbers of tests was demonstrated by considering the mean values obtained for small samples chosen at random.

The Story of Lac

Standard Quality Demanded

PROBABLY no one in this country knows more about lac in all its aspects than Mr. A. J. Gibson, Special Officer of the Lac Inquiry of the London Shellac Research Bureau. His review of the lac industry delivered during February to the Royal Society of Arts under the title "The Story of Lac" was therefore as authoritative as it was interesting. For many years Mr. Gibson has devoted his energies to this industry, which is the main support of large sections of the peasant population of India, and it is largely owing to his own efforts in encouraging research that he was able to conclude his lecture with the statement that only by the grossest mismanagement could harm come now to this industry dealing with a raw material of unique properties and in great demand. Natural lac is, of course, in competition with synthetic resins and it is essential therefore that it should be produced in standard reliable commercial qualities. Unfortunately, this has not been the case, for "TN" shellac, the standard grade that accounts for over three-quarters of India's annual shellac production is not trustworthy in quality, and this has been the principal cause, according to Mr. Gibson, why lac users have gone over to the more reliable synthetic resin.

"Since shellac came into the markets of the world, industrial practice has been revolutionised by the introduction of higher working speeds, increased loads, necessity for greater resistance to high temperatures, steam, water, oil, acids, alkalis, and other solvents and electrical stresses. Applied research in the case of a complex substance like lac only offers empirical solutions to problems of the above nature; lac can be made oil-soluble, it can be heat-hardened, it can be improved in a number of ways, but it is a definitely colloidal substance, its reactions to alkalis and acids are but little understood, and it is almost self-evident that for purposes of basic research, lac must be resolved into its components and the components studied singly and in combination with the other components or other substances to build up materials having the properties desired in the various lac consuming industries."

The above words were written by Mr. Gibson in 1934, and the policy therein outlined has, happily, borne fruit.

Shellac Chemistry

It is not always fully appreciated that shellac is one of the most versatile of raw materials from a chemical standpoint. It can be combined with almost any one of the starting materials used in the manufacture of synthetic resins, and hence with extended investigation should develop into one of the most important raw materials for synthetic resin manufacture. As the only resin produced by animal agency (a metabolic product of the insect *Laccifer lacca*) shellac has different properties from the remaining natural resins. Its chemical constitution has not yet been definitely determined. According to Dr. A. V. Blom, of the Federal Materials Testing Station, Zurich, it is apparently a mixture, which cannot be separated without causing secondary changes, of anhydrides, lactides, and intramolecular esters of aliphatic and aromatic polyhydroxycarboxyl acids. An important component is aleuritic acid, which has been isolated in the pure state and is a trioxypalmitic acid. The other components of shellac have not been determined with absolute finality. In the middle of the shellac molecule there are five hydroxyl groups. It is quite clear that in this raw material we have the phenomenon of solid solution of different chemical components. The principal chemical values of shellac can approximately be stated as follows:—

Acid value	65- 75
Iodine value	18- 20
Saponification value	225-231
Ester value	150-163

It should be clear from the above that a direct synthesis of lac by chemical means is not likely to succeed. In Berlin in 1932, Dr. Werner Nagel, of the Siemens-Schuckert concern showed Mr. Gibson a sample of synthetic lac he had built up from its component acids, as then known, but as the price of manufacture worked out at £80,000 per ton, it was hardly an economic proposition.

In the last two years in London the constitution of lac has been approached by indirect means. These studies have been based on investigating the molecular structure of the average lac molecule. It has been found that lac can be polymerised, that is to say, heat-hardened to stay put, and then depolymerised, which is the reverse process, a number of times, and each time the molecular weight increases, and the properties of the lac change. These various studies of the chemistry of lac, as Professor Gardner observes, "have proved invaluable in suggesting means of improving the uses of lac and for modifying the resin in adapting it to new uses."

The Institute of Chemistry

President's Report and New Officers

AT the sixty-fourth annual meeting of the Institute of Chemistry held last Monday, March 2, at 30 Russell Square, London, W.C.1, the President, Dr. J. J. Fox, C.B., O.B.E., the Government chemist, in submitting the report of the Council, said that the Institute had continued active in assisting various Government departments in matters concerned with the war. He remarked on the increase of 264 Fellows and Associates, bringing the total membership to over 8000 as compared with less than 1500 in 1914. There were not too many chemists and practically the whole of the profession was engaged on work of importance in the war. Even in times of peace, there had not been a serious surplus since 1918.

The three chartered chemical bodies—the Chemical Society, the Society of Chemical Industry, and the Institute—had made progress in a co-operative scheme for the supply of chemical publications and the maintenance of the Chemical Library at Burlington House. The majority of Local Sections of the Institute had continued to hold meetings for the discussion of technical papers, and questions of professional interest, including the future policy of the Institute and the possibility of further co-operation, or even union, with other organisations.

It was sometimes said that chemistry needed more publicity. As in other professional technical work any advance in chemistry that could be understood by the public or by those who directed industry was soon the subject of comment; but without such advances, it was not reasonable to expect people to notice chemistry any more than any other profession. There was no doubt, however, that chemistry stood higher than ever to-day in the world of affairs, and its influence for the good of humanity would grow steadily.

Dr. Fox was re-elected President of the Institute and the other officers and members of Council for the ensuing year were elected as follows:—Vice-presidents: Professor H. V. A. Briscoe, Dr. Alexander Findlay, Dr. L. H. Lampitt, Mr. G. R. Roche Lynch, C.B.E., Sir Robert H. Pickard, F.R.S., Dr. H. A. Tempany, C.M.G., C.B.E. Hon. Treasurer: Mr. J. C. White, M.C., O.B.E.

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Among the vice-presidents, Dr. Findlay and Dr. Lampitt, who were members of Council last year, take the place of Dr. F. H. Carr and Professor T. P. Hilditch.

Law of Patents and Designs

Provisions of the New Statute Explained

by F. Tebbutt

IN law generally, periods of time are important. This is particularly true in the law of patents and designs, and applies notably to the Patents and Designs Act, 1942, recently passed. A patent runs for sixteen years, that is if the necessary renewal fees are paid, but an extension is obtainable by application to the High Court, one provision being by "petition" and the other by "originating summons." Application in either case must be made not later than six months before the date when the patent would ordinarily expire, although the court can allow a later application, but not later than the actual date of expiry.

Methods of Extension

Under the "petition" rules, regard must be paid to the nature and merits of the patent in relation to the public, the profits of the patentee as such, and to any other relevant circumstances, and an extension is granted only if the Court considers that the patentee has been inadequately rewarded by his patent. By the other provision, which allows application by "originating summons," *i.e.*, a summons on a non-contentious matter, a court judgment being required, the patentee as such must have suffered loss or damage (including loss of opportunity of dealing in or developing the patent through his having been engaged on work of national importance) by reason of this country being at war, and the Court need only have regard to this aspect of the case in coming to a decision. An extension under either of the provisions can ordinarily only be for five years or, in exceptional cases, ten years, or alternatively the Court has power to grant a new patent with such restrictions, conditions, and provisions as it considers necessary.

Now, by the 1942 Act, in relation to the "war losses" provision, application is allowable, even after the actual date of expiry, if the reason for the delay in making an application for extension is due to the absence of the patentee on active service, or through circumstances arising from the war. Previously only one extension could be given, but by the new statute, as regards the war losses provision, an extension can be given even though there has previously been an extension or a new patent granted, and whether this was granted under the "war losses" rule or under the other provision explained above. It should also be noted that the five-year and ten-year extension limits will not apply to the war losses provision, but if the Court so decides extensions can be given, by order or orders or by a new patent, which may total up to ten years.

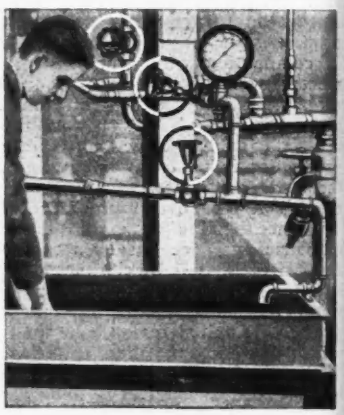
International Reciprocity

A feature peculiar to Patent Law is that it is really international, that is as regards countries who are members of the International Union for the Protection of Industrial Property, known as "Convention" countries. Thus, if protection is given in one country, similar protection can be obtained in any of the other Convention countries, if application is made within the proper time and according to the law of the particular country concerned. For this country, if application has been made in a Convention country, priority is given to an application made here, provided that this is made within twelve months after the date of application in the foreign country in question (designs: six months). The new Act gives power to the Board of Trade to extend the time limit mentioned, if the applicant has been prevented by the law or by Government action from making the application within the required time. Furthermore, rules will provide that where there has been reciprocal interchange of information or articles between this country and another country (*e.g.*, an ally) the inventor will not be prejudiced as regards an application for a patent or registration of a design in this country.

Valve Position Indicator

Importance of Correct Setting

IN operating steam-heated or steam-driven equipment, correct valve setting is important, while in manufacturing and processing operations it is equally desirable to know the exact amount of gas, oil or other fluid passing through the valves. A visible type of valve setting indicator, which shows at a glance the exact degree the valve is open, is the Arkon Valve Position Indicator. This indicator takes the place of a handwheel for smaller sizes of valves and will fit any screw-down valve. For larger sizes of valves it is fitted at the top of the existing handwheel. It incorporates a dial, suitably graduated, over which a red segment moves, indicating the valve opening. Thus, with the valve shut, the red portion is not visible. As the valve opens the red segment moves across until, in the fully-open position, it entirely covers the dial.



Cleaning metal parts in a continuous flow of chemical solution composed of three liquids. The degree of flow of each liquid is controlled by Arkon Valve Position Indicators

This indicator is extremely sensitive in operation, and once the correct setting for any process is determined the valve can again be regulated quickly and with accuracy to the same position. It is easily read, even from a distance, and can be fitted in any position, horizontally or vertically. The Arkon Valve Position Indicator is manufactured by Messrs. Walker, Crosweller & Co., Ltd., Cheltenham, Glos.

RAPID SOAPMAKING

Discovery of a way to make soap in fifteen minutes is claimed by Joseph J. Jacobs, of Brooklyn Polytechnic Institute. Fat is dissolved in kerosene, in his process, and solid lye added. The mixture is then heated to a temperature higher than is now feasible. The lye reacts with the fat in less than fifteen minutes to make soap, and this hot mass of soap and kerosene is then sprayed into a vacuum chamber. Here the kerosene and pure glycerin vaporise off, leaving behind a dry, granular, porous, quick-dissolving soap. The kerosene and glycerin are condensed and separated, and the kerosene can then be re-used for a new batch. The heat costs are about one-twentieth of those of present methods. Industrial soap and high-grade toilet soaps can be made by this process, it is claimed.

In their Bulletin No. F8-B1, the DENVER EQUIPMENT CO., LTD., of Denver, Colorado (London office, 493a Northolt Road, South Harrow, Middlesex), show, by means of some very interesting diagrams and illustrations, the design and capabilities of their 18-in. rotary filter, which is specially valuable in industrial and chemical plants; Bulletin C12-B1 deals in the same clear manner with their anti-friction bearing jaw crusher, while Bulletin No. P6-B covers pumps of various types, as used in the chemical industry.

Metallurgical Section

Published the first Saturday in the month

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Metallurgical Section

March 7, 1942

REFRACTORIES IN WAR TIME

Satisfactory Position of the British Metal Industries

by DESMOND EYLES

MECHANISED war depends on abundant supplies of highest quality iron, steel, aluminium, magnesium and other metals. These, in turn, depend on high-grade refractories without which it would be impossible to melt the enormous quantities of metal required for the sinews of war. It may even be said that progress in the manufacture of iron, steel and most other metals depends largely on concurrent progress in refractories.

"Refractories" is the general name given to a variety of materials used in building and lining furnaces and for other heat-resisting purposes. They are, generally speaking, manufactured from non-metallic minerals and rocks and, according to the circumstances of their use, must be able to stand up to various requirements such as extremely high temperatures, changes of temperature, the corrosive effects of slags and furnace gases, the action of molten metals, pressure, and abrasion. In view of rearmament programmes and the threat of war, all the great industrial countries were engaged in intensive research in the refractories field for many years before the actual outbreak of war. Principal aims of such research were: (1) to improve the quality of refractories made from native raw materials; (2) to substitute synthetic refractory materials for those which it might be difficult to import in time of war; and (3) to develop entirely new refractory materials. Naturally, the emphasis on any particular aim differed in various countries, according to the conditions.

Fireclay and Silica

In Great Britain, we are fortunate that nature has supplied us with abundant sources of the two most extensively used refractory materials—fireclay and silica. Both in this country and in the United States, fireclay brick still remains the most widely used refractory. Since the war of 1914-1918, great improvements have been made in manufacture and fireclay bricks are now available which will stand temperatures up to 1400° C. or even higher, under load. The introduction of power-pressing, casting, and vacuum methods of manufacture, the careful choice and preparation of raw materials, and burning at higher temperatures have all combined to produce high-grade bricks, thus enabling fireclay to retain its predominating position.

For the roofs of open-hearth steel furnaces, and in coke ovens and metallurgical hearths, bricks of almost pure silica are widely used. Their resistance to certain slags and furnace gases is superior to that of fireclay bricks and the fact that they do not shrink is another advantage. On the other hand, they have certain disadvantages which govern their use in any particular case; they are very sensitive to sudden changes of temperature, and an excessive amount of steam in the atmosphere is liable to cause deterioration, especially if the iron oxide content of the bricks is somewhat high. It has been found, however, that the sensitivity of silica bricks to sudden temperature changes is reduced by insulating the furnace with suitable insulating bricks. Further endeavours are being made to replace silica by basic refractories for the roofs of open hearth furnaces.

Sillimanite, a mineral of exceptionally high refractoriness, has a higher alumina content than fireclay. Sillimanite bricks will stand temperatures up to 1800° C. without melting or cracking, and they are used for building, lining, and repairing certain parts of furnaces, especially those used in glass manufacture. The most important deposits of sillimanite are found in India and U.S.A., so that our requirements have been assured. It is not without significance to note that, as early as 1930, Germany had begun manufacturing *synthetic* sillimanite bricks on an industrial scale and in 1935 it was stated that this method had become general. At the same time, however, the quality of sillimanite bricks supplied by Germany to Holland became inferior. Bricks of higher alumina content than ordinary fireclay bricks are also produced by adding bauxite to the fireclay. Bauxite was originally imported from the South of France, but is now obtained from British and Dutch Guiana and British Honduras, where there are ample supplies to meet all our needs.

Magnesite—Natural and Synthetic

During the last war, steel foundries in Great Britain were hindered to a certain extent by the cessation of magnesite imports from Austria, which then supplied about two-thirds of the total world demand. Magnesite bricks are used for basic linings in converters and furnaces, one of their main advantages, compared with fireclay and silica, being their great resistance to certain corroding influences. Good magnesite bricks will stand temperatures up to 1700° C. and they are superior to most refractories in their resistance to basic meltings. Magnesite walls are very little affected by phosphorus in the Thomas process.

Any difficulties we might have had during the present conflict because of a shortage of magnesite have been overcome by the development of magnesite synthetically made from dolomite and sea water. Synthetic magnesite bricks are being made both in this country and the U.S.A. It is interesting to note, moreover, that extensive Empire deposits of crystalline magnesite are found in Canada and the Sudan, and of amorphous magnesite in India, South Africa, Australia, and Canada. The present tendency, however, is towards the replacement not only of magnesite, but also of chromite and silica bricks by chrome-magnesite refractories. Although the latter are more expensive, they are more durable and therefore more economical in the long run. According to one American authority, the optimum brick of this class comprises a mixture of 75 per cent. chrome ore and 25 per cent. dead-burned magnesite. It is also stated that the addition of chromite to Canadian magnesite has been found to result in an excellent refractory brick with good resistance to changes of temperature. Large quantities of chrome-magnesite refractories are used for the walls and roofs of electro-steel furnaces. They are also used in the copper and cement industries, their outstanding qualities being resistance to slags and to sudden changes of temperatures.

As far as chrome ore is concerned, our main pre-war sources were Greece, Turkey, and Cuba. Importation is now in the hands of a Control Department of the Ministry of Supply, and any difficulties which may have existed have now been overcome. The indifferent refractoriness of chromite bricks under load is their weakest point and partly accounts for the trend towards chrome-magnesite bricks, already mentioned. Incidentally, there are vast sources of raw materials for chrome refractories in several of the British Dominions and Colonies, particularly South-West Africa and Rhodesia.

Water-resisting dolomite bricks represent a new type

of basic refractory which has been developed during the past few years, although ordinary dolomite was probably first used as a refractory material over sixty years ago and is still used on a large scale. The great disadvantage of dolomite, compared with other refractory bricks, has been their sensitive reaction to air and water, and the object of research in this field has been to perfect a water-resisting dolomite brick. This is now in use in about 90 British steel works. It is reported that a Norwegian invention produces a still better brick of this type, which is being used in the Swedish steel industry.

Considerable progress had been made prior to the war in the development of forsterite (olivine) bricks, a particularly noteworthy feature of which is their very slight shrinkage even at temperatures as high as 1800° C. Such bricks are now in industrial use both in the U.S.A. and the U.S.S.R., especially for copper furnaces, but we miss our previous Norwegian supply of raw material. Germany and Italy are producing synthetic forsterite bricks from serpentine and magnesite.

There has been an increasing use of pyrophyllite in the United States, and firebricks made of a mixture of pyrophyllite and refractory clay are said to stand temperatures up to 1690° C. and to have a high resistance to spalling. Zircon and zirconia products also seem to be making some progress in the United States; they are of particular interest to this country because they show the greatest resistance against coal slag, a very important factor as far as our power stations are concerned. The largest zirconium deposits are in the British Empire. Mention must also be made of the importance of graphite (plumbago) crucibles for melting brass, copper, aluminium, nickel, iron, steel, and precious metals. Suitable raw materials are found in Madagascar and Ceylon. Graphite and fireclay crucibles are of particular importance in the aluminium industry in Great Britain. In Germany, both these materials are used, but also special barium-aluminium-silicate refractories.

Advantages of Carbon Bricks

Since about 1912, Germany has been using refractory carbon bricks, made mainly from coke and tar, to an ever-increasing extent. Before the war, they were also being used in Soviet Russia, Sweden, Belgium, and Italy on an appreciable scale for those parts of blast furnace linings which have to stand up to the highest temperatures. Carbon bricks have a better resistance, under load, to high temperatures than best-quality fireclay bricks, and they react neither with blast-furnace slags nor with the alloy constituents of pig-iron. Another advantage is that they can be made in quite large blocks, thus reducing the number of joints. The heat conductivity of carbon bricks is 15 to 20 times that of fireclay bricks, a factor which permits much more intensive cooling of linings than is possible when fireclay bricks are used. Both in Great Britain and U.S.A. great interest has been shown in carbon blocks and bricks and it may be assumed that research work in this field is now even greater than in Germany.

Hot face insulating bricks are being used in Great Britain up to 1400° C. and in U.S.A. and Germany up to 1500° C. Rapid strides have been made in the application of insulating firebricks, ranging from installations where these bricks are used to back up a refractory wall to those in which they are directly exposed to the flame in high-temperature furnaces. By the use of suitable insulating bricks, a furnace is brought up to the required temperature in less time, and great heat losses through the walls and roof are prevented. For temperatures up to 800° C. much use is made of diatomaceous earth, now imported from Ireland and Portugal, and for higher temperatures fireclay and china clay bricks are mainly used. These are made porous by the introduction of sawdust which is burned out during the firing. In U.S.A. and Germany, greater use is being made of porous sillimanite bricks.

As far as this country is concerned, it may be said that the war time situation with regard to refractories is satisfactory. Pre-war research had already ensured the best possible use of those refractory materials which are found within our own boundaries, and sufficient imports of other materials are obtainable either from other parts of the British Commonwealth or from our allies. The superiority of British war weapons is due in no small measure to the progress already made in the refractories field and the constant striving for still higher quality has led to important developments, full details of which it will only be possible to publish when sanity returns to a distraught world.

United States Copper

Records Broken by the Industry in 1941

THE outstanding feature of the American copper industry in 1941 was the unprecedented demand for the metal, according to the Bureau of Mines, United States Department of the Interior. The record-breaking use of copper was to satisfy armament requirements of the United States and to aid in supplying the war needs of countries entitled to aid under the Lend-Lease Act. This enormous use of copper was accompanied by an unchanged price and by an increase in smelter production from domestic sources of only eight per cent. Imports of crude and refined copper established a new annual record, while exports of refined copper and primary fabricated shapes apparently were the smallest since 1901. Inventories of blister and refined copper in the hands of primary smelters and refineries changed little during the year.

Results of a preliminary survey on copper, covering 11 months' actual figures, plus company estimates for December, are given below.

Copper produced by smelters from domestic ores, in lbs.

1937	1,669,322,278
1938	1,124,656,539
1939	1,425,349,488
1940	1,818,167,516
1941	1,959,000,000

The estimated production for December amounted to 174,000,000 lb. or nearly 7 per cent. above the average for the preceding 11 months.

Refinery production of new copper from domestic sources gained 4 per cent. in 1941 and that from foreign sources was 10 per cent. higher, accounting for a rise in total new copper of 6 per cent. Production of refined copper from foreign sources reached a new annual peak in 1941, amounting to 2,774,000,000 lb. Production of secondary copper at primary refining plants was estimated to have fallen 24 per cent. in 1941.

Statistics on imports and exports after September, 1941, will not be released by the Bureau of the Census. Total imports of unmanufactured copper during the first nine months of the year were already 7 per cent. above the total for all 1940, previously the highest total on record. The imports for nine months of 1941, by countries, are reported as follows in lbs):

	Unrefined.	Refined.
Canada	40,560,121	7,594,081
Mexico	64,211,741	—
Chile	245,508,041	390,460,860
Peru	46,937,217	—
Belgian Congo	54,999,529	—
South Africa	13,274,700	—
Great Britain	—	200,038
	465,491,349	398,254,979

Exports during the first nine months of 1941, at only 217,397,609 lb. of metallic copper, undoubtedly indicate the smallest annual total since 1901. This class includes the primary stages of fabrication such as rods and pipes and tubes, but excludes the insignificant quantity reported as ore. The confidential nature of foreign trade data since September prevents the usual annual calculation on apparent consumption. Incomplete figures furnish conclusive proof, however, that consumption in the United States, as determined by use in the primary stages of fabrication, reached the highest level in history, surpassing previous records for 1940 and 1929 by a substantial margin, probably by more than 50 per cent.

Controlled Oil Quenching*

An Important Step Towards Fuel Economy

THE increasing use of alloy steels has led to rapid advances in furnace design, including accurate control of the temperature. Highly refined and stabilised quenching oils are now available with suitable viscosity and conductivity characteristics. The importance of maintaining quench baths at pre-determined and specified temperatures throughout heat-treatment operations is also generally known, but so far little has been done to control the temperature of the quenching oil in use, or to determine the temperature most suited to the particular steel being heat-treated and, in consequence, in some plants considerable scrap is still being produced. Temperature control is essential if consistent quality is to be obtained from successive quenchings of batches.

If the oil is too cold, the setting up of rapid convection currents will make satisfactory quenching difficult as the oil film will not be mobile and this will result in a lowered rate of heat transfer from the metal to the oil, together with local "cracking" of the oil and consequent deterioration of its characteristics. If this wastage is to be avoided it is necessary for means to be provided for raising the temperature of the oil quickly to the correct level before quenching starts. On the other hand, if the oil is too hot (as may occur towards the end of the day, or when an increased output is required), vapour pockets tend to form round the material being quenched and patchy hardness results. Further, the increased volatility of oil at high temperatures causes unnecessary losses through evaporation and increases the risk of surface fires. For the greatest efficiency and safety, means should therefore be provided for controlling—preferably automatically—any variations in the temperature of the oil.

Oil coolers of the shell and tube type, using water as the cooling agent, are satisfactory if means are provided for controlling the oil temperature. They may, however, be expensive in operation, in spite of low first cost, unless well or river water is available in ample quantities and at low pumping cost. When mains water is used and is allowed to run to waste, the low first cost is offset by heavy running costs. Closed-circuit air coolers, which may be satisfactory in cold weather, cannot generally cool the oil sufficiently in warm weather. Open-circuit air coolers, in which the oil is allowed to come into contact with atmospheric air, suffer from the same disadvantage and, in addition, tend to cause excessive oxidation of the oil with resulting sludging and increase in acidity, and the consequent necessity of frequent renewals of oil if consistent quenching is to be obtained.

The "Prestcold" oil cooler, manufactured by The Pressed Steel Co., Ltd., Cowley, and distributed by Wild-Barfield Electric Furnaces, Ltd., Watford, is based on the design of the well-known atmospheric evaporative water cooling system commonly used with refrigeration plant, but the heat transfer coefficients and constants which are involved have been established only after much research. This cooler is of the closed-circuit type, and excessive oxidation of the oil is thus avoided. On the other hand, evaporation of the cooling water enables drastic reductions in water consumption to be made, with consequent reduction in running costs. A typical example may be cited. The water consumption in an installation cooling the oil in tanks handling one cwt. per hour from the normal hardening temperature is only about 5 gallons per hour, a fraction of the consumption in the older types of cooler.

The most important feature is perhaps the automatic control of the temperature of the bath. By means of a thermostat, the cooler is set in action as soon as the temperature reaches a predetermined figure, whilst overcooling is prevented by the same means. Furthermore, if desired, heaters, either steam or electric, can be incorporated to bring the temperature of the quenching oil to a desired point before quenching begins. Such a feature is useful where quenching in oil at too low a temperature might result in cracking, a state which arises, for example, after the plant has been shut down over a week-end.

The "Prestcold" oil cooler consists of a galvanised heavy-gauge sheet steel casing of all-welded construction, mounted on a shallow mild steel plate water tank, the whole being carried on a steel channel frame. Removable

* From "The Wild Barfield Heat-Treatment Journal," *4*, 30/31, p.36.

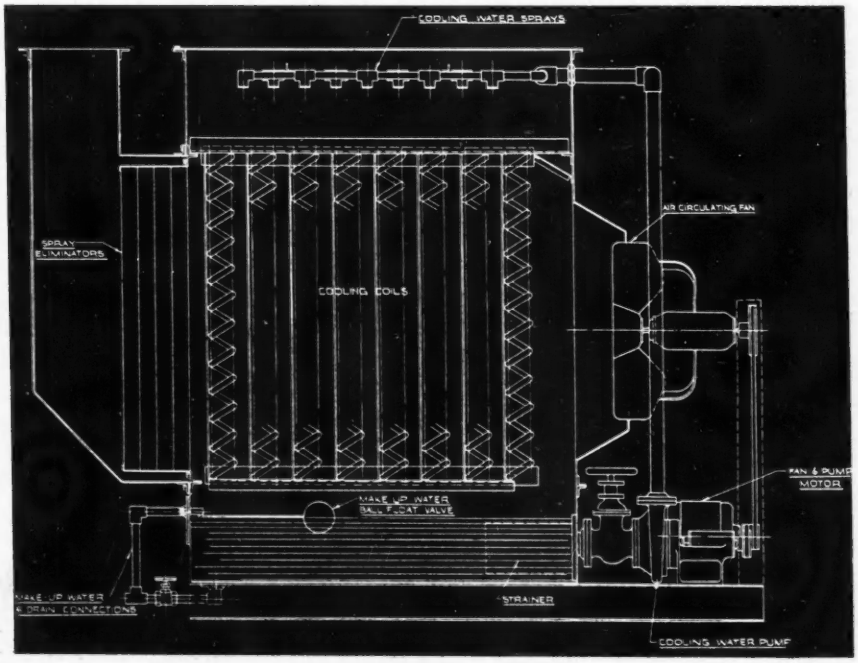

Diagram illustrating the general arrangement of the "Prestcold" evaporative oil cooler. The cooling coils are seen in the centre, the spray eliminators on the left, and the axial air-circulating fan on the right. The sprays themselves are at the top, while the anti-choking strainer for the make-up water is underneath

inspection covers are fitted on each side of the cooler. Inside the casing is mounted a bank of seamless steel cooling coils, having a galvanised finish, connected by headers through which the oil is circulated by a pump at the most suitable velocity.

At one end is mounted an axial flow fan which propels the required quantity of air over the cooling tubes. This fan is driven by a guarded "V" belt from a motor mounted on an extension of the sub-frame, and the same motor drives a small centrifugal pump which lifts water from the tank in the base and forces it through a series of atomising nozzles at the top of the cooler. A strainer is incorporated in the circuit to prevent choking of the nozzles. The water falls down in a fine rain inside the casing and keeps the cooling tube surfaces continually wetted. A drift eliminator ensures that the finely atomised water carried along to the end of the casing by the air stream is caused to deposit and drain back into the tank, thus keeping water consumption to a minimum.

As the air driven through the casing and over the oil tubes is unsaturated, it has the ability to take up more water vapour by evaporation. The latent heat of evaporation is used to remove the heat from the oil circulating through the tubes and to maintain the water at a substantially constant temperature. The small quantity of water used will be apparent since more than 1000 B.Th.U. are required to change 1 lb. of water from the liquid to the vapour state. Water is maintained at a constant level in the tank in the base by means of a ball float valve which admits make-up water from the mains.

At the end of the housing opposite the fan a saturated air exhaust outlet is provided to which trunking can be attached to carry the exhaust outside the shop. A thermostatic control automatically cuts the cooling in or out, according to the temperature of the quench bath.

Five standard sizes have been developed to suit requirements, ranging from 25,000 B.Th.U. to ten times that amount, and other capacities can be catered for by special designs.

The automatically controlled quenching conditions which the use of the cooler ensures, remove the uncertainties and inconsistencies so frequently met. Control in steel manufacture and proper furnace equipment are now necessities, and conditions demand the continuation of proper control right through to the finished article. Tests have shown the enormous saving in oil if controlled temperatures are maintained, and as every gallon of oil saved means a saving in shipping space, the importance of this point cannot be overstressed.

LETTER TO THE EDITOR

Economy in Steel

SIR,—It is becoming more and more evident that drastic economy is essential in the use of alloyed steels and it may not be long before restrictions in their use may be necessary. This, however, need not alarm many users of alloyed materials, especially where these are being employed largely for the purpose of resistance to wear. This need can be met in the surface hardening by this company's process applied to the mild carbon as well as to the high carbon steels. Where core ductility and toughness is essential, in combination with surface resistance to wear, several mild alloy steels may be employed, which by proper surface hardening will give the required service. Steels that can be heat-treated to between 40 and 65 tons can be safely surface-hardened without upsetting the core properties.

Another feature of local hardening that may be invaluable to designers to meet economy requirements is the use of low carbon mild steels. Parts which can be carburised where required to be hardened may be allowed to cool down slowly in the furnace, and afterwards be locally hardened, so avoiding distortional troubles such as occur on quenching. Many parts made in this way may be finish-machined before the final hardening operation.

Metallurgists have of late called special attention to the advantages of steels known as carbon high manganese or manganese carbon steels, which are capable of good ductile properties under correct heat treatment and of hardening to a high degree. Attention is also drawn to the value of plain carbon steels manufactured by a process which ensures a controlled grain size. Tests have revealed high tensile properties combined with high izod figures. The President of the Institution of Mechanical Engineers recently published some very intersting data on some of these steels under test.

Another interesting economy in steels may be worthy of mention, and is offered in the work of fabrication by welding. Mild steel employed for a fabricated structure can often be used in combination with carbon steel built into the structure at the places where resistance to wear can be obtained by the Shorter hardening of these areas. As a typical example of this, the fabricated gear wheel in which the teeth are cut is made of a carbon steel, so that the flanks of the teeth can be hardened.—Yours faithfully,

SHORTER PROCESS COMPANY, LTD.,
Sheffield. A. E. SHORTER, M.B.E., M.I.Mech.E.,
February 16, 1942. Managing Director.

Metallurgical Specifications

High Purity Zinc

TWO new British Standards for zinc have just been published (under one cover, price 2s. 3d. post free): B.S. 1003, "High Purity Zinc," and 1004, "Zinc Alloys for Die Casting." These have been prepared in order to standardise, for high purity zinc die casting alloys, the compositions, impurity limits, and methods of control which have been generally approved as good practice.

The development of dependable zinc alloys of high mechanical properties has resulted in a rapid increase in the use of zinc alloy die castings for engineering purposes. These alloys, however, are specially notable in their extremely low tolerance of some impurities, particularly lead, cadmium, and tin which, in excess of the specified maxima, cause liability to intercrystalline corrosion with resultant dimensional instability and loss of strength. Certain of the harmful impurities are always to be found in appreciable quantities in zinc ores, and the basic zinc for the manufacture of these alloys must be specially produced to meet the necessary requirements of chemical composition. Another and serious potential source of impurities in these alloys lies in contamination during remelting of ingot metal.

Ferrous Pipes and Piping

A new British Standard for Ferrous Pipes and Piping Installations (B.S. No. 806—1942) is also to be recorded. It applies to the construction of the pipework connecting a land steam boiler to engine, turbine or industrial plant and all auxiliary pipework in connection therewith. It does not apply where temperature exceeds 900° F. In determining the working stresses to which pipes may be subjected, the various physical properties of the pipe material have received attention. After consideration of the ultimate tensile stress, yield point, proof stress and proportional limit of steel, it has been decided to use the proportional limit as the basis for working stresses, and the reasons for this are set out in an appendix.

Arc Welding Plant

The British Standards Institution has issued a revision of B.S. 638, Electric Arc Welding Plant and Equipment and Welding Accessories. The present revision has been undertaken in order to give effect to modifications which appeared necessary since the original specification of 1935. Considerable criticism was raised about the unwieldly character of the cable and a somewhat lighter and more flexible type of cable has now been specified. Provision has been made for D.C. and A.C. reactors and requirements have been included relating to voltage regulation for both welding generators and transformers. The appendix sets out in detail the information to be included on the rating plates for each type of equipment. Other alterations relate to temperature rises, recommended voltage values of the rating current, etc.

Personal Notes

MR. OLIVER LYTTELTON, Minister of State in charge of war production, has arrived in London after a successful air trip from Cairo, where he had been since last July.

WING-COMMANDER E. L. COLBECK-WELCH, R.A.F., who has been awarded the D.F.C., is the son of Mr. G. M. Colbeck-Welch, M.C., director of Hickson and Welch, Ltd., chemical manufacturers, Castleford, Yorkshire.

SIR ALEXANDER KEOWN-BOYD, who has been appointed chairman of the new Economic Advisory Committee which is to recommend means for increasing war production in the Middle East, was before the war representative in Egypt of the Bradford Dyers' Association.

PROFESSOR A. W. M. ELLIS, who occupies the Chair of Medicine in the University of London, has been appointed director of research in industrial medicine by the Medical Research Council. Professor Ellis was formerly Fellow in Pathological Chemistry at the University of Toronto.

CAPTAIN RICHARD ANTHONY PILKINGTON, M.C., who was this week appointed Civil Lord of the Admiralty, has been Conservative M.P. for Widnes since 1935. Connected as he is with the famous glass-making family, he has always taken a great interest in the chemical activities of his constituency.

MR. WILLIAM HENRY STEVENS, A.R.C.S., F.I.C., of Monsanto Chemicals, Ltd., who lately visited America at the request of the Ministry of Aircraft Production to study American methods of producing Thiokol synthetic rubber (as recorded in THE CHEMICAL AGE on September 6), has recently spoken on the same subject in the radio programme broadcast to the Empire and the U.S.A.

MR. T. B. KEEP, M.I.Mech.E., managing director of the Brush Electrical Engineering Co., Ltd., Loughborough, has retired from the board of that company, but is remaining on the boards of Brush Coachwork, Ltd., and Petters, Ltd. MR. ALAN P. GOOD, deputy chairman of the Brush Electrical Engineering Co., Ltd., succeeds Mr. Keep as managing director, and MR. M. A. FIENNES has joined the board as an executive director. Immediately prior to his joining the Brush board Mr. Fiennes was responsible for the armament production of United Steel Companies, Ltd.

A special meeting of Luton Borough Council was held last week to pay tribute to MR. HARRY ARNOLD, Freeman of the Borough and thrice Mayor of Luton, whose forty years' service to the borough came to an end with his resignation from the Council last December. Mr. Arnold, who, though close on 80 years of age, still retains his position as chairman of B. Laporte, Ltd., chemical manufacturers, of Luton, was presented with handsome souvenirs of his municipal career. After a laudatory speech by the Mayor, Councillor J. Burgoyne, the resolution of the Corporation's gratitude to Mr. Arnold was read by the Town Clerk and proposed by Councillor A. W. Gregory, who described Mr. Arnold as "a modern Dick Whittington."

Obituary

MR. ALFRED EDWARD WEBB, who died at Prestwood, Bucks, on March 2, was formerly managing director of Palmer and Co., Ltd., candle, soap, and oil- and paint-dryer manufacturers, Stratford, Essex, and director of Wilkins, Campbell and Co., Ltd., wax manufacturers, West Drayton, Middlesex.

An explosion occurred recently in a big chemical factory near Dusseldorf, from the debris of which 192 bodies have been recovered, states a Moscow wireless report. After the explosion foreign workers in a neighbouring chemical factory started a strike, refused to go back to work, and demanded to be allowed to return home. The Nazis are said to have executed 40 Italian workers, on the ground that they were the leaders of the strike.

Chemical Matters in Parliament

Chemical Bleaching of Flour

LAST week in the House of Commons, Sir E. Graham-Little asked the Lord President of the Council whether he was aware that in August, 1940, the Medical Research Council reported that flour for bread should contain the wheat-germ and that chemical bleaching of flour should be prohibited, but that up to the present 95 per cent. of the flour issued had been deprived of all of its wheat-germ and been chemically bleached. Sir J. Anderson said he was aware of the recommendations made by the Medical Research Council, but as regards the prohibition of chemical bleaching and "improving," further investigation was necessary.

New Control Orders

Wheat Gluten Manufacture

THE Minister of Food has made the Wheat Gluten (Licensing of Manufacturers) Order, 1942, which prohibits, except under licence, the use of any wheat, wheat product or wheat by-product in the production of gluten for sale or use by way of trade. The Order comes into force on March 16, and manufacturers who wish to continue production should apply as soon as possible for a licence application form to the Cereal Products Division, Mount Stewart, Colwyn Bay.

Export of Asbestos Scrap

Under the Export of Goods (Control) (No. 9) Order, 1942 (S.R. & O. 1942, No. 313) which becomes operative on March 17, control is extended to cover containers made from black plate and, in the case of certain destinations, to asbestos scrap and waste. The Order also extends the existing control in respect of paper, paper board, and certain articles manufactured therefrom.

British Chemical Prices

Market Reports

ONLY a moderate volume of new business in industrial chemicals has been transacted during the past week, but on the whole the movement in supplies has been fairly substantial since contract deliveries to the chief consuming industries have been very satisfactory. The majority of the soda products are quoted at strong rates, with the bichromate, yellow prussiate, and chlorate being called for in greater quantities than are at present available. In the potash section, too, the scarcity of supplies and the strong values are the chief features. In other sections of the market prices continue steady, with formaldehyde fairly active, and a steady demand is being put through for acetone, arsenic, and acetic acid. Activity in the market for coal tar products is mainly confined to ex contract deliveries, and here a steady movement has been maintained. A quiet business has been transacted in both the naphthas and the xylols which are now subject to licence under a recent control order. Cresylic acid and carbolic acid are in steady demand, but the pyridines remain comparatively dull.

MANCHESTER.—Taking the trade as a whole, conditions have been fairly active on the Manchester chemical market during the past week. A steady contract business has been reported in the general run of soda compounds, and also in the ammonia and magnesia products, as well as in a number of miscellaneous items, whilst a moderate volume of new inquiry has been dealt with. Quotations have been steady throughout the range. With an odd exception supplies of the tar products are being well absorbed, especially of the light materials, and prices are on a stable basis.

GLASGOW.—There is no change in the Scottish heavy chemical trade. Home business remains steady. Export business is rather restricted on account of various causes. Prices remain very firm and, where altered, have a tendency to rise.

Price Changes

Calcium Acetate.—MANCHESTER: Grey, £26 per ton.
Cresylic Acid.—MANCHESTER: Pale, 99/100%, 5s. 6d. per gal.
Lead Acetate.—MANCHESTER: £51 to £54 per ton.
Xylol.—MANCHESTER: 3s. 1d. to 3s. 5d. per gal.

General News—From Week to Week

Import duties into Eire on dry batteries, sodium carbonate, and copper tubes are suspended until July 31, 1942.

The prices of lubricating oils and greases has been advanced from March 2. The amount of the increase depends on the blending of the lubricant.

The Ministry of Food announces that there will be no change in the existing prices of oils and fats allocated to primary wholesalers and large trade users for the four weeks ending March 28.

Owing to increasing membership and the need for larger premises, the British Plastics Federation, Ltd., announce that from March 20 their address will be 47/48, Piccadilly, London, W.1. (Tel. REGent 4681/2).

The Board of Trade has made the Export of Goods (Control) (No. 11) Order, 1942 (S.R. & O. 1942, No. 367), which came into force on March 6. Under its terms export licences will in future be required for all goods consigned to Burma. At the same time the Board has issued an Order revoking all outstaninding Export Licences for Burma (S.R. & O. 1942, No. 368).

The following Fellows have been elected by the Board of the Institute of Physics; C. A. Adams, B.Sc.; G. O. Baines, M.A., Ph.D.; R. H. Herz, Dr.Phil.Nat.; G. Lubszynski, Dr.Ing.; G. R. Noakes, M.A.; and T. H. Redding, M.Sc., A.R.C.S. At the same time, 31 Associates, 11 Subscribers and 17 Students were also admitted.

Hemicelluloses have been isolated from sugar-cane fibre (bagasse) which had previously been freed of sugars and pectin, and a report has been made by B. L. Davis and M. Phillips (*J. Agric. R.*, 1941, *63*, 4, p. 241). The product obtained was light grey and was practically free of nitrogenous substances and lignin. On hydrolysis with dilute sulphuric acid it afforded *d*-glucuronic acid, *l*-arabinose, and *d*-xylose in the approximate molar ratio of 1:0.87:21.9.

Men from the china clay industry, it has been suggested, should be drafted into the tin mines of West Cornwall. The Metallurgical Department of the Ministry of Supply is bent on the speed-up of home-produced tin, and if the mines are to be developed, it is imperative to increase the mining staff. Whether the china clay industry could safely release more than a small proportion of the men still left is doubtful, as clay is also an essential product, and the decision will depend upon the Ministry.

The joint committees in Royal Ordnance factories, the establishment of which was announced in THE CHEMICAL AGE on February 14, have now received a written constitution, signed by members of the trade unions concerned and by representatives of the Ministry of Supply. They will consist usually of ten representatives each from the workers and the management, with the factory superintendent as chairman. Meetings will be held fortnightly, or as required, but the workers' panel will meet weekly in order to expedite procedure.

At the recent Council meeting of the Society of Chemical Industry a unanimous resolution was passed that the president, Dr. Cullen, should serve for a second year. The president, however, while thanking members, said he preferred to follow the normal procedure, and suggested that past presidents should be asked to make nominations as usual. The Council agreed, on condition that their desire for Dr. Cullen to serve again was expressed when calling for nominations. Drs. Cox, Jordan, and Lessing were re-appointed representatives of the Society on the Joint Library Committee of the Chemical Council.

Part of the rapid growth in the industrial use of the platinum metals (especially in the manufacture of war materials) is due to the extensive use of platinum as a catalyst in the production of nitric and sulphuric acids. Platinum alloys perform an important function in producing artificial silk and are also vital components of the modern electrical instruments used by our fighting forces. Palladium is increasing in importance as an alternative to platinum for many industrial chemical processes. Further details are contained in the review of the Platinum Metals Industry for 1941, by Charles Engelhard, recently published by The International Nickel Company.

During January, the Ministry of Food announces, there were 2420 prosecutions under the Food Control Orders, of which 2218 (91.65 per cent.) were successful. These prosecutions were taken against wholesalers, retailers, members of the public and other offenders against food regulations. Since the war started 42,347 prosecutions have been undertaken by the Ministry, of which 39,736 have been successful.

Foreign News

United States exports of animal charcoal, deodorising and decolorising and gas-absorbing carbons to South American countries increased greatly during the period 1938-40, rising from 31,900 lb. in 1938 to 35,100 lb. in 1939, and 625,200 lb. in 1940.

Production of sodium sulphate in Canada in 1941 was estimated to have been 124,762 tons, valued at $924,000, compared with final figures of 94,260 tons, valued at $829,589 in 1940, according to preliminary statistics issued by the Canadian Department of Trade and Commerce.

United States production of manganese ore containing 35 per cent., or more manganese in November, 1941, was 12,700 long tons, shipments were 13,000 tons, and producers' stocks at the end of the month were 1000 tons, according to the Bureau of Mines.

The Reynolds Metal Co., Inc., Richmond, Virginia, has entered into aluminium production with a plant at Listerhill, Alabama, and another at Longview, Wash.; a third one is in construction. Total annual output for the three plants will be 160,000,000 lb. of virgin aluminium metal.

The most important suppliers of formic acid to the Netherlands Indies were the Netherlands and Germany, and the Netherlands and Japan were the most important suppliers of acetic acid. Since May, 1940, replacements of these important rubber coagulants have been obtained in increasing quantities from the United States.

Forthcoming Events

A joint meeting of the **Chemical Engineering Group** (Society of Chemical Industry) and the **Institution of Chemical Engineers** will be held on **March 10,** at 2.30 p.m., in the Rooms of the Geological Society, Burlington House, Piccadilly, W.1, when a paper on "Noise and its Suppression" will be presented by Mr. N. Fleming, M.A., of the National Physical Laboratory.

A joint meeting of the **Chemical Society** with the **Leeds University Chemical Society** will be held on **March 10,** at 5.15 p.m., in the Physiology Lecture Theatre of the School of Medicine, Leeds, when a discussion on the "Enzymatic Breakdown of Tryptophan to Indole" will be opened by Dr. H. A. Krebs, Dr. F. C. Happold, and Dr. J. W. Baker.

A domestic meeting of the Food Group of the **Society of Chemical Industry** will be held in the afternoon of **March 11,** at Burlington House, when the following papers will be read: "Food Substitutes," by Mr. Voelcker; "Corrosion in Cans," by Mrs. S. M. L. Tritton; and "Prepared Meats: Some Technical Aspects of their Manaucfture," by Mr. Osman Jones.

A meeting of the **Pharmaceutical Society** will be held in the Society's House, on **March 12,** at 2.30 p.m., when six short technical papers will be read.

There will be a joint meeting of the **Institute of Chemistry** with the London and Home Counties Section of the **Institute of Physics,** at the Royal Institution, on **March 18,** at 2.30 p.m., when Professor M. L. E. Oliphant, F.R.S., will lecture on "The Applications of Nuclear Physics in Chemistry and Biology."

A meeting of the London Section of the **Institute of Fuel** will be held at the Connaught Rooms, at 2.30 p.m., on **March 19,** when Dr. Ezer Griffiths, F.R.S., of the National Physical Laboratory, with one of his collaborators, will present a paper on the general subject of heat transfer and insulation, which will be followed by a discussion.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

COLDSTART PETROLEUM PRODUCTS, LTD., Bradford. (M., 7/3/42.) Feb. 16, £1900 mortgage to R. B. North, Bradford, and another; charged on land, home farm and cottage adjoining and two cottages, 61 and 63, all Myers Lane, Bradford. *Nil. Jan. 25, 1941.

STOCAL ENAMELS, LTD., Birmingham. (M., 7/3/42.) Feb. 10, debenture to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *Nil. June 18, 1941.

NEW PROCESS WELDERS, LTD., Southall. (M., 7/3/42.) Feb. 11, mortgage to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; charged on contract moneys. *3950. Dec. 26, 1941.

Receivers Ceasing to Act

BRITISH CHEMICOLOUR PROCESS, LTD., London, E.C. (R.C.A., 7/3/42.) D. Ross. Dec. 10, 1941.

Company News

The Viscose Development Co., Ltd., report a final dividend of ¼ per cent., making 7 per cent. for the year (10 per cent.).

Lightalloys, Ltd., have declared an interim dividend of 12½ per cent. (same).

The Kern Oil Co., Ltd., has declared a dividend of 6 per cent. (8 per cent.) for the past year.

John Oakey and Sons, Ltd., have declared a net profit for 1941 of £35,303 (£37,039), and a dividend of 7½ per cent., making 10 per cent. (same).

Millor Proprietary, Ltd., announce a net profit for the year ended September 31, of £41,677, and a dividend of 12½ per cent. on ordinary shares.

The Anchor Chemical Co., Ltd., report a net trading profit for the year ended November 30, of £82,208 (£79,390), and have declared a final dividend of 15 per cent., making 25 per cent. for the year.

The Egyptian Salt and Soda Co., announce a net profit for the year ended August 31, of £E119,578 (£E97,019), and have declared a dividend of 4s. per share, less tax (3s. per share, less tax).

Chemical and Allied Stocks and Shares

FOLLOWING the lead of a rise in British Funds, improved conditions developed in the stock and share markets, and at the time of writing industrial securities have risen slightly on balance. The disposition to await war developments prevented any marked recovery in the volume of business, but on the other hand, owing to the continued absence of sellers, many stocks and shares were in short supply. Consequently, where demand was better, the tendency was for market values to show strong response. As was to be expected, most securities of companies with interests in the Far East were lower on balance; buying has centred mainly on securities of companies concerned with home trade and work of national importance. In many instances, yields on the basis of last year's dividends are on the small side, and bearing in mind all factors, including the weight of taxation, there would seem to be few companies which will be able to make improvement in future dividends. Shares of chemical and kindred companies have been favoured, in common with those of other companies whose activities are of national importance, and which appear to offer the prospect of reasonable dividend payments during the period of the war.

Imperial Chemical were active, and have improved to 32s. 7½d. at the time of writing, which compares with 32s. 4½d. a week ago; while the 7 per cent. preference made the higher price of 35s. Although now "ex" the dividend, Borax Consolidated deferred units at 29s. 4½d. were quite well maintained on balance, having remained under the influence of the higher earnings shown by the preliminary statement. The full report and chairman's annual review are being awaited for indications whether the company's home trade and its interests in the U.S.A. can be expected to offset the loss of Continental and other markets. Lever and Unilever were little changed at 26s. 3d. Courtaulds failed to hold best prices recorded recently, but at 31s. 6d. xd. were little changed on balance for the week, despite the lower dividend and the directors' cautious statement regarding the American Viscose position. In fact, most movements in textile and kindred shares were small and unimportant. Calico Printers preference remained around 14s. awaiting the dividend decision. Elsewhere, British Aluminium at 44s. 3d., and British Oxygen at 67s. 6d. were relatively steady, the disposition being to await the forthcoming results. There was no very decided tendency among iron, steel, and similar securities, it being realised that the fall in profits and the absence of a dividend from Dorman Long are due to special circumstances affecting this company. The shares of the last-named showed a heavy decline at one time, but have since made a partial rally to 15s. 9d. Stewarts and Lloyds improved 6d. to 46s., but at the time of writing Tube Investments have a somewhat easier appearance at 84s. 3d.

In other directions, United Molasses were firmer at 31s. 6d. The units of the Distillers Co. were 76s. 3d., aided by market expectations that the dividend may very well remain on a 16¼ per cent. basis. Murex went back from 90s. to 88s. 9d., sentiment being influenced by uncertainty as to whether the company's future earnings may be affected by the restricted supply of special ores and metals from the Far East. Elsewhere, B. Laporte remained at 63s. 9d., and business in Fison Packard was recorded at close on 40s., while Cooper McDougall and Robertson ordinary shares have remained at 24s. 4½d. Greeff-Chemicals Holdings 5s. units were 5s. 7½d., and British Drug Houses 25s.

Boots Drug were firmer at 33s., and Turner and Newall 69s. General Refractories remained at 8s. 10½d., awaiting publication of the results. There were few dealings among shares of companies with interests in plastics; British Industrial Plastics 2s. ordinary were 3s. 1½d. and Erinoid 5s. ordinary 7s. 9d. Oil shares were inclined to improve, but "Shell" and Burmah Oil continued to be affected by the Far East war news.

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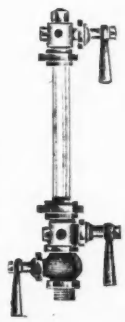

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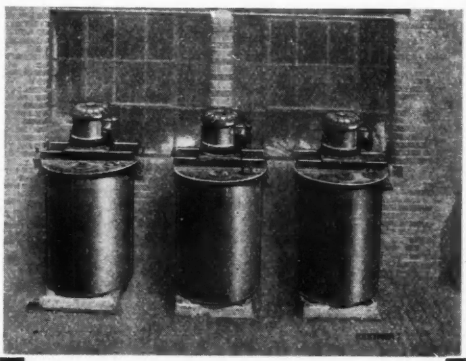

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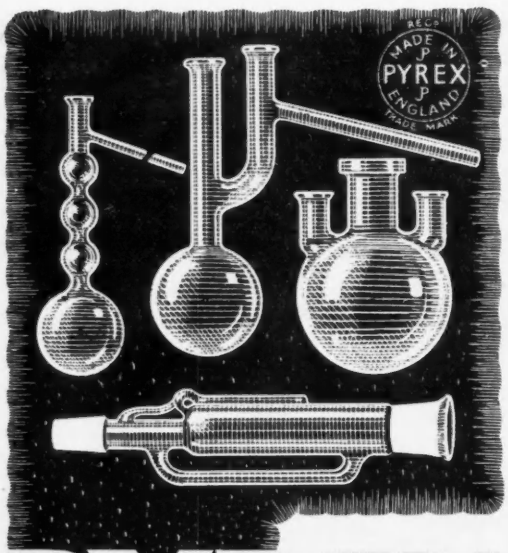

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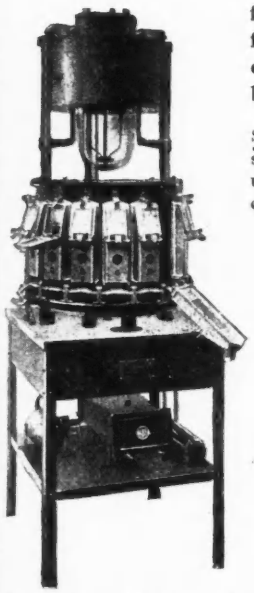

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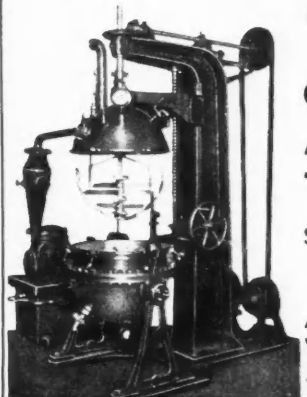

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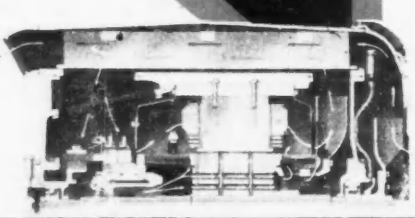

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